

The Effectiveness and Cultural Practicality of Ceramic Water Filters in the Kiwcha Community of Ecuador

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Abstract

Diarrhea is one of the leading causes of morbidity and mortality of children less than 5 years of age in developing countries^{Prüss}. Eighty-eight percent of diarrheal disease is due to unsafe water supply and inadequate sanitation and/or hygiene. There is conclusive evidence that household-level water sanitation can reduce diarrheal incidences^{Clasen}. The goal of this study was to determine if ceramic water filters implemented in 2010 reduced the prevalence of parasites and diarrheal diseases in Pukara Quinche compared to Huashig, which received no water filters. Our data collected 2011-2013 suggests that the water filters implemented at Pukara Quinche had a positive effect on water quality and awareness of the correlation between clean water and good health. The data also shows a decrease in prevalence of intestinal parasites, but the relationship to the water filters implemented is inconclusive.

Ceramic Water Filters

A ceramic clay pot, made of fine sawdust, clay and dirt, is placed in a dispensing storage container. Water is purified through a filtration process wherein bacteria and protozoa are eliminated via size exclusion as water passes through the porous clay. The typical flow rate is 1-3 liters per hour. The ceramic water filters are impregnated with colloidal silver to further reduce Clostridium and E. Coli presence. The filter has been shown to be 99.54% effective at eliminating E. Coli bacteria - a very high percentage considering the physical size of this strain - and 100% effective at filtering out parasite eggs^{Rodriguez}.



Sample Survey, Sample Collection and Analysis

Households were selected based on the availability of the residents and on the recommendations of the head community leader. A brief survey was administered verbally at the participants' home. A local community leader translated the survey from Spanish to Kichwa, and vice versa. The survey asked about their opinions on water filters, how they use and clean their water, frequency of using and cleaning their water, beliefs about water quality and its relation to health, and beliefs concerning diarrhea. During the interview, residents were told that a health care worker will come by next week to dispense the fecal sample container for collection.. Members of the community dropped their fecal samples in the town center the following morning and the samples were then taken down to the Chimborazo province hospital.

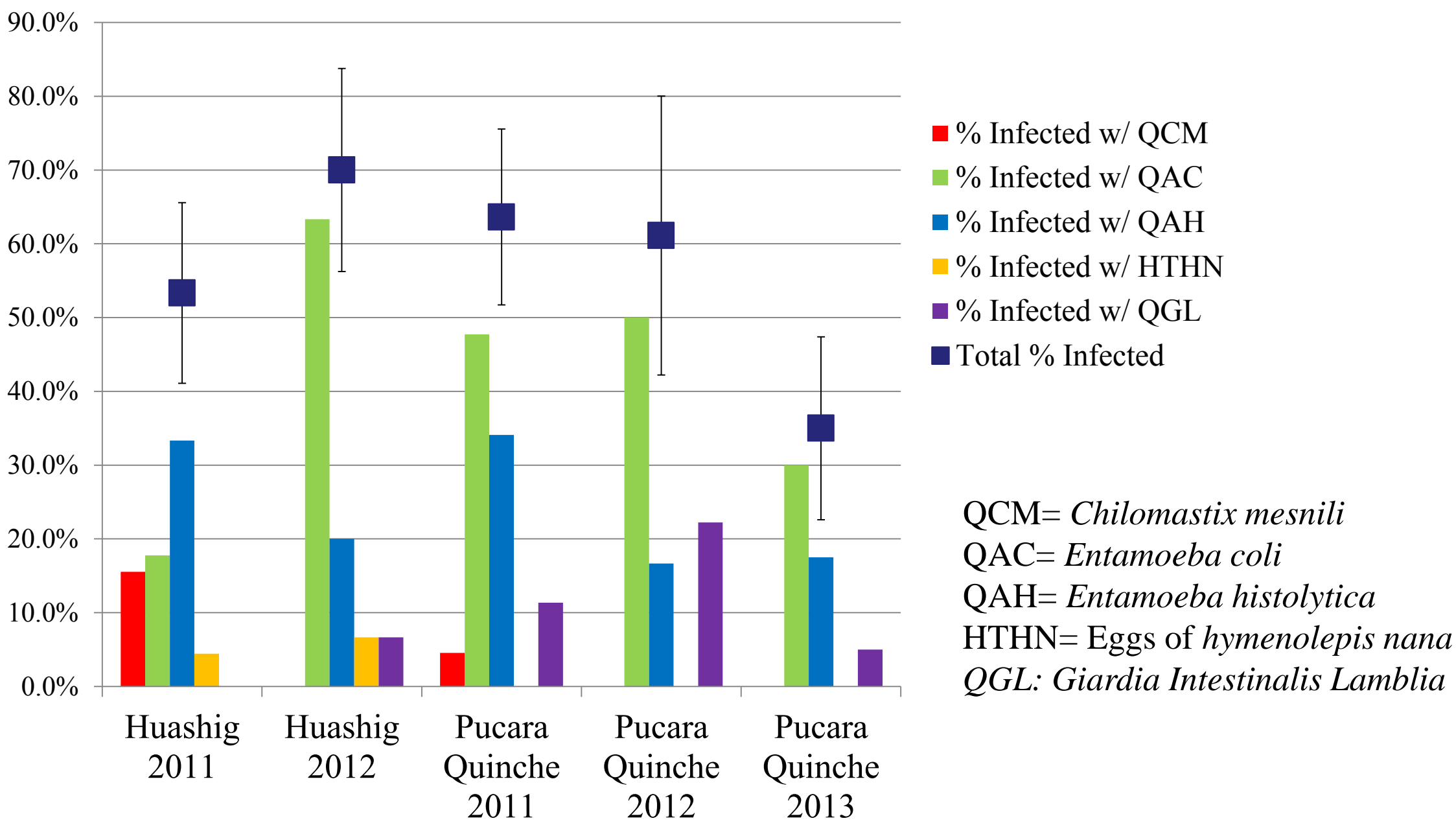
Water samples were taken from 2 random houses in Pukara Quinche, 1 from Huashig and 1 from the health center in Pukara. The image below shoes the result of the water sample. The result on the right is from Huashig, which shows a high level of coliform presence. The last two from Pukara Quinche shows a significant reduction of coliform. The sample from the health center (not shown) showed no traces of coliform.

Fecal and Water Samples were sent to Escuela Superior Politécnica de (ESPOCH) for analysis.



Methods and Results:

Fecal Analysis from Huashig and Pucara Quinche from 2011-2013



Analysis of Results

Using the Wald significant test, we conclude that Pukara Quinche has a lower prevalence of disease in 2013 than previous samples from Huashing and Pukara Quinche with confidence of 95%. Pukara Quinche had a significant reduction in E. Coli from 50% to 30% from 2012 to 2013 as well as Giardia Intestinalis *Lamblia*, from 22% to 5%. However, we were unable to collect control samples from Huashing for 2013 due to lack of resident participation in sample collection. Due to this lack of data, we cannot confidently conclude that this reduction in disease in Pukara Quinche is solely due to the water filter intervention. The image to the Right lower corner, shows the water typical in a typical residential home.



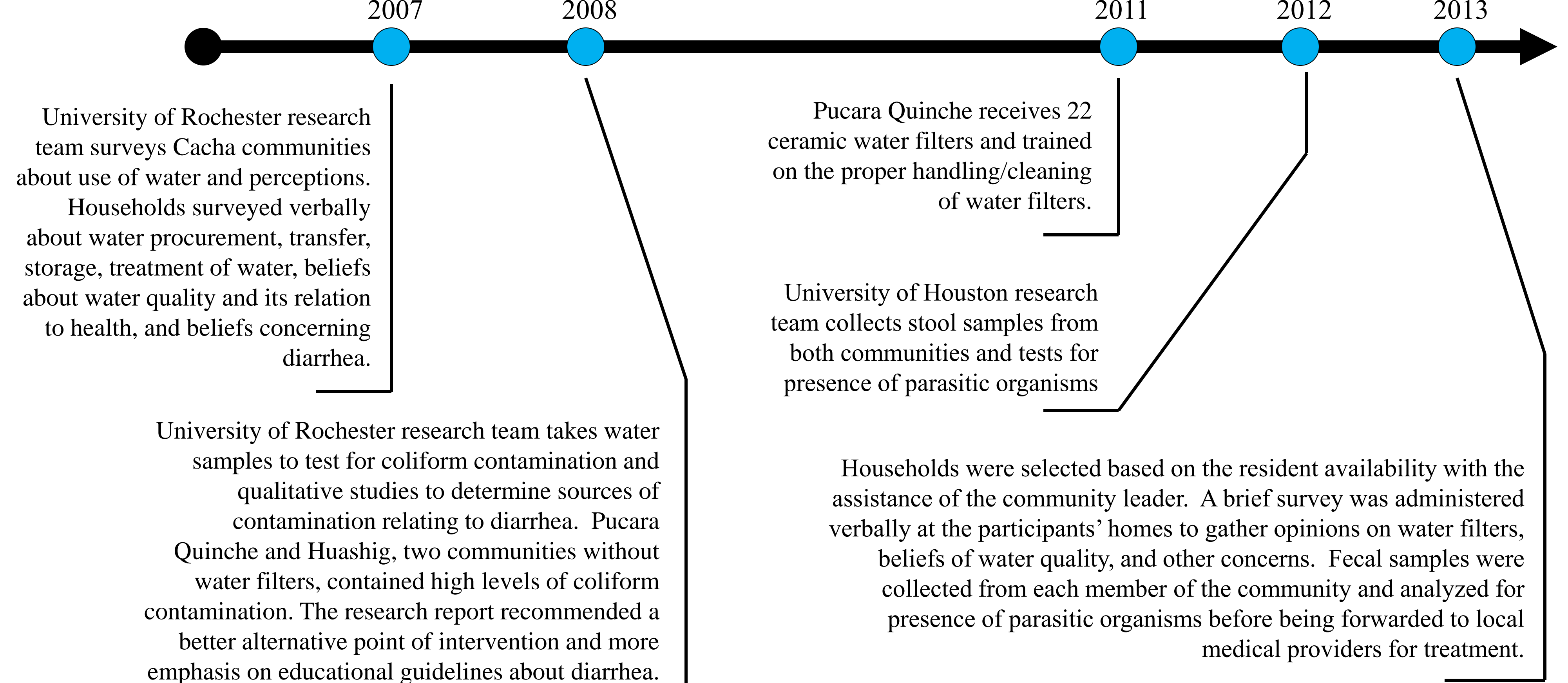
Discussion & Conclusions

Overall, the water filters are generally well accepted in Kiwcha. The water filters helps to effectively eliminate bacteria, makes it more palatable for users and is more culturally acceptable since most cultures store water in jars or clay pots. It changes their cultural belief about water and health. Additionally, members with filters state that they only drink water from a reliable source such as their filter or bottled water while members from the other community drink from either tap water, un-boil or boil. This demonstrates that the water filter help increase awareness about the relationship between water and health and improve the cultural water belief.

For the disadvantages, sustainability was an issue. Broken filters were laying unused since the members did not know where to repair the broken component. Many individuals expressed the need for another workshop on how to clean and handle their filters. Another equally important negative aspect about the water filter is that it also does not acknowledge the fact that people can get parasitic transmission from other sources. In fact, many of the homes have dirt floors as well as raise at least one kind of animal (ie: guinea pigs, sheeps, dogs), providing several possible routes of transmission ^{Jacobsen et al}. For example, Jackson et al showed that households with dirt floors had higher rates of E. histolytica and G. intestinalis

Limitations : External factors such as transmission from dirt floors or animals were unable to be wholly captured. Gender and age were not included in the statistical analysis, and the yearly data doesn't consider the fact that you are not testing the same people. During the interview, parents may have inaccurately recall any recent abdominal illnesses that may have occurred in the past year.

Timeline



Cultural Barriers

From an anthropological perspective, the collaboration and cooperation of the local community is vital to the success of a research project. Fecal samples has been collected and analyzed since 2011 in both communities. Members of the both community have stated that they have given their fecal samples in previous years but have never received their results or treatment. Many members were reluctant to provide fecal samples because they felt they were continuously providing help to the research project but receiving nothing in return. For decades, this indigenous community has become marginalized by their government; only in the past decade have they finally won the fight for water rights^{Landeo}. Thus, a natural sense of distrust has developed against outsiders helping them. In addition, cooperation with the local health leader is also important in order to help deliver the treatment needed as well as provide continuity. For instance, their primary health care provider was also not informed about the previous years' data collection. This situation disregarded the provider's role as a physician in providing anti-parasitic pills to infected members; thus, these further highlights the fact that collaboration at all levels, from individual family members to the local doctors, are essential.

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